(12) UK Patent Application (19) GB (11) 2 137 279 A

(43) Application published 3 Oct 1984

(21) Application No 8401869

(22) Date of filing 25 Jan 1984

(30) Priority data
(31) 3302650 (32) 27 Jan 1983 (33) DE

(51) INT CL³
F01L 3/02

(52) Domestic classification
F1B 2Q13 2Q3C

(56) Documents cited
GB 1542088 US 4359022 EP A 0066733
GB 0928691
GB 0665330

(58) Field of search
F1B

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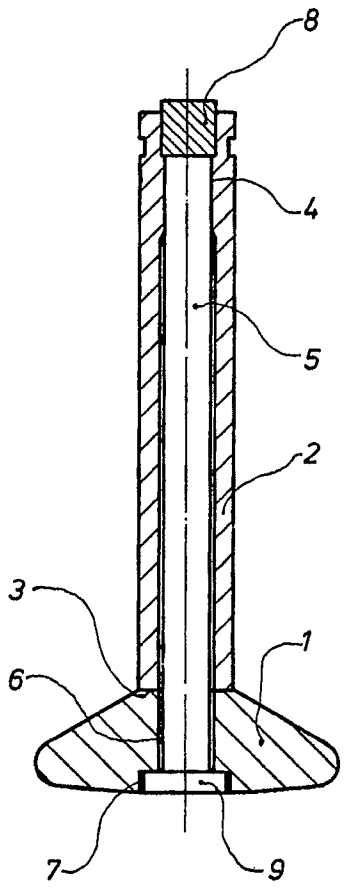
(54) Valve for an internal combustion engine

(57) A valve for an internal combustion engine having a mechanically highly stressed valve stem of metallic material and a non metallic valve head which is positively connected thereto and which consists of e.g. silicon carbide or silicon nitride. The stem may comprise tube 2 and rod 5, clearance gaps 6, 7 being established so that the valve may self centre.



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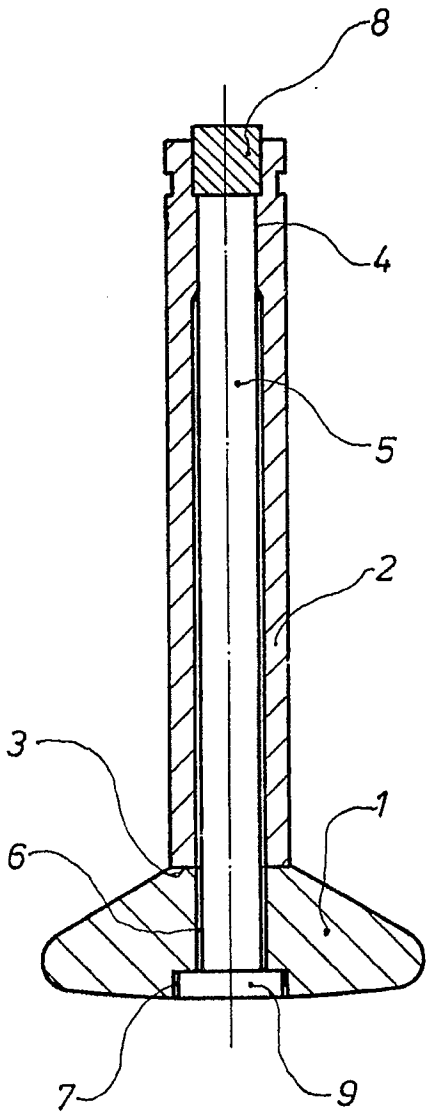

SPECIFICATION

Valve for an internal combustion engine

The invention relates to valves, particularly exhaust valves for internal combustion engines. Until now only valves of chromium-nickel or alloys containing tungsten have become known in practice. Where fuels with additives containing lead are used, layers which prevent the deposition of combustion products are formed on the metallic surface. Lead-free fuels however result in deposits. When the regions of the deposits break up, gaps are formed between the valve head and the valve seat when the valve is closed. Incandescent gases, which result in local overheating at the periphery of the valve head, can penetrate through these gaps during the combustion stroke. A further disadvantage of metal valves resides in the large weight of the valve, because the opening forces and accordingly also the power derived from the crank shaft for driving the valve also increase proportionately to the valve weight, as does also the weight of the valve drive.

The invention eliminates these disadvantages. According to the invention the valve head consists of a highly oxidation-resistant material, whose surface has only little affinity to combustion products containing graphite. Silicon carbide and silicon nitride have proved to be particularly suitable. These two materials are characterised by low specific gravity, extreme oxidation-resistance and very great hardness. As a rule silicon carbide is particularly advantageous because of its greater thermal conductivity compared with the other materials. However, the great hardness is associated with the disadvantage that the material is appreciably more brittle than the metal alloy hitherto used. The forces which result from eccentric displacement between the axial guide and the valve seat have been found to be particularly critical. By way of an improved embodiment, the invention provides a variant in which the valve is not integral but consists of a head of hard material and a metal stem. In accordance with the invention this stem is so formed that, within the limits of manufacturing tolerances, which result in eccentricity between the valve axis and the stem axis, radial displacement between the head of hard material and the stem is possible.

The last-mentioned embodiment will be described with reference to a drawing.

In order to compensate for the lower tensile and bending strength of the hard materials, the head 1 extends somewhat further into the interior of the cylinder, which may necessitate moderate recesses at the bottom of the piston. The stem consists of a tube 2, which abuts the annular region 3 of the head 1 and which has a reduced bore 4 in the upper region. Inside this tube there is provided a cylindrical rod 5, which is bonded to the region 4. The radial gaps 6 and 7 permit slight radial displacement of the head 1 with respect to the tube 2 of the stem, so that the valve head 1 can centralise itself with the valve seat. In the upper region an anvil 8 of a hard material, e.g. silicon carbide, is pressed in, which transmits the opening forces.

CLAIMS

1. A valve for an internal combustion engine, at least the head of the valve being made of a non-metallic hard material.

2. A valve according to Claim 1, wherein said material is silicon carbide.

3. A valve according to Claim 1, wherein said material is silicon nitride.

4. A valve according to any one of the preceding claims having a stem comprising a tube with a rod extending therethrough.

5. A valve according to Claim 4, wherein the tube is seated on a planar annular face of the valve head.

6. A valve according to Claim 4 or Claim 5, wherein the rod and the tube are interconnected at the end remote from the valve head.

7. A valve according to any one of Claims 4 to 6, wherein the end region of the stem which is remote from the valve head also consists of a hard material.

8. A valve according to any one of Claims 5 to 7, wherein the materials of the tube and of the rod have respective coefficients of thermal expansion such that the distance between said annular face and the end of the rod at the valve head remains constant within the temperature range of operation of the valve.

9. An exhaust valve for an internal combustion engine, said exhaust valve being a valve according to any one of the preceding claims.

10. A valve according to Claim 1, constructed substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

11. An internal combustion engine having at least one valve according to any one of the preceding claims.

12. An internal combustion engine having at least one valve according to any one of Claims 4 to 8, wherein the valve head has a first central bore and a second central bore of larger diameter than said first central bore adjacent to the latter in a direction remote from the valve stem, a first radial gap being provided between the rod and the wall of said first bore and a second radial gap being provided between an enlarged terminal portion of the rod and the wall of said second bore, both said gaps being larger than the eccentricity between the valve seat and the valve stem guide determined by manufacturing tolerances.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1984, 4235.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.